

Analysis of Radar Visibility for Proposed Canadian Weather Radars

*Norman R Donaldson¹, Ingrid Wong², Qian Li², Peter Leibiuk², Steven Brady²

1. Environment and Climate Change Canada, OBRS/MRD/STB, 2. Environment and Climate Change Canada, CWRRP/MSC

Environment and Climate Change Canada is upgrading its weather radar network and needs to estimate radar visibility in a number of scenarios. In most cases the new S-band radars replace C-band radars on the same site, which involves moving the antenna by tens of metres in height and the horizontal. At some sites, X-band radars provide temporary coverage after a C-band radar is removed for the installation of the S-band radar. For some S-bands entirely new sites must be found. At all sites the primary interest is potential blockages of the radar beam, with a secondary consideration of ground or sea clutter. Information comes primarily from SRTM digital elevation models (DEMs), supplemented with other sources. The DEM processing is similar to several previous studies in the literature, but involves more consideration of tree cover and structures.

For existing sites the starting point is an historical assessment of blockage of the C-band radars. This helps identify non-terrain issues such as buildings, towers or trees. For obstacles that are within hundreds of metres of the site, azimuth and elevation from the new antenna could differ enough that satellite imagery and local surveys are used to identify them. At long ranges, moving the antenna by tens of metres does not significantly change the angular relationships. These considerations can be used to amend tower heights relative to current towers.

For new X- and S-band sites, raw DEM estimates are used for an initial triage of potential sites followed by more detailed consideration of specific sites. In these cases the DEM may need to be supplemented, especially at forested locations. Since the X-band antennas are only 7 m above the ground, a fairly careful assessment of nearby obstacles is needed. On-site visits can provide height estimates. At some locations a small drone has been used to create panoramic images from the approximate proposed location of the antenna. The DEM analysis allows the raw terrain data to be supplemented with those estimated heights. It is worth noting that the existence of quite local blockage requires the DEM analysis to be done with much higher range resolution than previous studies.

Overall, the predictions of blockage seem to be working well and observations from new radars have not deviated significantly from analyses. After installation, the elevation angles of X-band scan strategies have been optimized by tenths of degrees to reflect the real-world. On the other hand attempts to predict clutter areas have been at best mediocre.

Keywords: radar blockage, canadian weather radars